



Audrey Fern Foundation Quarterly



Summer 2013

THE HARDY FERN FOUNDATION

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The Hardy Fern Foundation was founded in 1989 to establish a comprehensive collection of the world's hardy ferns for display, testing, evaluation, public education and introduction to the gardening and horticultural community. Many rare and unusual species, hybrids and varieties are being propagated from spores and tested in selected environments for their different degrees of hardiness and ornamental garden value.

The primary fern display and test garden is located at, and in conjunction with, The Rhododendron Species Botanical Garden at the Weyerhaeuser Corporate Headquarters, in Federal Way, Washington.

Affiliate fern gardens are at the Bainbridge Island Library, Bainbridge Island, Washington; Bellevue Botanical Garden, Bellevue, Washington; Birmingham Botanical Gardens, Birmingham, Alabama; Coastal Maine Botanical Garden, Boothbay, Maine; Dallas Arboretum, Dallas, Texas; Denver Botanic Gardens, Denver, Colorado; Georgia Perimeter College Garden, Decatur, Georgia; Inniswood Metro Gardens, Columbus, Ohio; Lakewold, Tacoma, Washington; Lotusland, Santa Barbara, California; Rotary Gardens, Janesville, Wisconsin; Strybing Arboretum, San Francisco, California; University of California Berkeley Botanical Garden, Berkeley, California; and Whitehall Historic Home and Garden, Louisville, Kentucky.

Hardy Fern Foundation members participate in a spore exchange, receive a quarterly newsletter and have first access to ferns as they are ready for distribution.

Cover design by Willanna Bradner

HARDY FERN FOUNDATION QUARTERLY

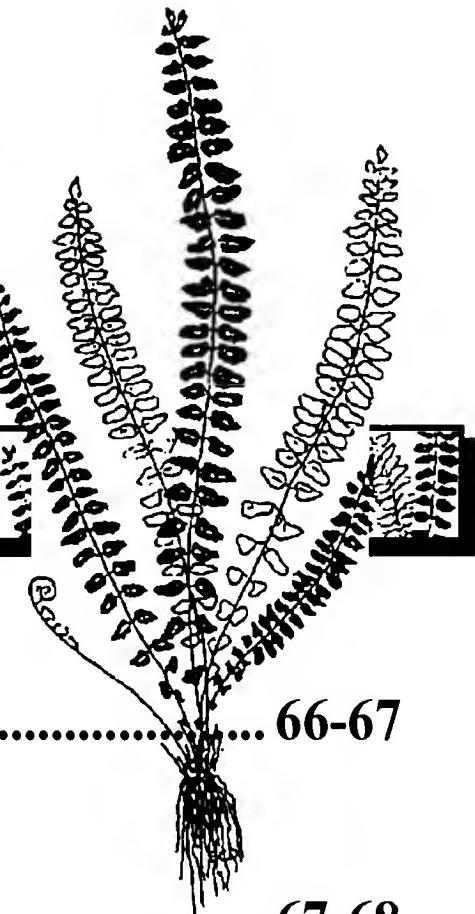
THE HARDY FERN FOUNDATION QUARTERLY

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Correction - The illustration on page 48 of the Spring Quarterly should be labeled *Polystichum centronepalense* not *P. centropaleaceum*.

President's Message

The annual Fern Festival was held the weekend of June 7 & 8, at the Center of Urban Horticulture at the University of Washington. This is the Hardy Fern Foundation's major event of the year, with a fantastic fern sale, dinner and lecture. This is the 40th year of the sale. Previous to the Hardy Fern Foundation (1989), the sale was sponsored by the Northwest Horticultural Society. This has become one of the pre-eminent fern sales in the country with over a hundred fern species and varieties to choose from. We had an entertaining lecture and slide show from Sue Milliken and Kelly Dodson focusing on their plant collecting trips to China. They have collected numerous plants from their travels and offer them through their nursery, Far Reaches Farm, in Port Townsend, WA. Their catalogue lists over 5000 species. This year, forty four foundation members and friends sat down to a sumptuous feast in the adjacent atrium for a marvelous meal before the lecture was to begin and after a busy day of fern and plant sales. The fern sale continued the next day, Saturday. It was a great weekend meeting and great getting to know fellow fern enthusiasts. Many thanks to Pat Riehl for leading the efforts and to all the members, staff and volunteers who contributed in putting this show together and for making it such a success. Special thanks also to Kathryn and Jerry Crosby for putting together a series of beautiful matted fern prints and note cards that were offered at the Fern Festival. A nice addition to the plant sales. Fern sales were up approximately twenty percent over last year.

We were fortunate to have the company of Naud Burnett and Ken Kratz from Casa Flora in Dallas, TX, visiting the festival and area gardens over the weekend. HFF has a special relationship with Naud and Casa Flora. Naud has been very generous to HFF constantly sending ferns to try and offering support of the organization. A nice get together and meal with HFF board members and friends, was hosted by Pat and Walt Riehl on Saturday evening. A nice ending to a Fern Fest weekend.

Welcome to new HFF board member, Linda Pyles. Linda wasted no time in getting involved helping throughout the Fern Festival. Linda also organized the 3rd annual HFF Summer Garden Tour featuring four incredible Snohomish County Gardens during a delightful event on June 30.

A few weeks ago, HFF members and friends were entertained and dined by Susie and Kevin Egan. Susie and Kevin have a wonderful woodland garden at their home, Cottage Lake Gardens that has the distinction of having every species of Trillium in existence along with numerous ferns and other woodland treasures. Susie is very active in the Trillium Society where she takes responsibility for collecting and disseminating seed. I had a great time learning and seeing. Also a thank you to Susie for taking over from Jane Whiteley, as the HFF recording secretary, and thank you Jane for fulfilling that post these past three years. It is much appreciated.

I was sitting on the patio today, Father's Day, one week before the official start of summer, looking at a potted *Osmunda regalis* and the clusters of sporangia at the tips

of the fronds. Some of the sporangia were green, some were tan in color and some were half way between. I got up and softly whacked the fertile frond tips and a cloud of light green colored spores wafted up and across the patio carried by an ever so slight breeze. *Osmunda* is a very old fern genus some 200 million years old. This fern genus has been wafting spore around the planet for a very long time and is found in many areas of the world. Imagine the changes in climate that they have endured, changing their range over the years in response to the the global changes incurred by numerous cosmic and geological changes and events. Cosmic and geological events not only spell doom for numerous species of fauna and flora but also set the stage for the rise of new species clamoring for a foothold in a new environment. Chance and circumstance are ever so present in evolutionary success.

Happy Fern Gardening,

John van den Meerendonk

***Athyrium niponicum ‘Pictum’* Japanese Painted Fern**

James R. Horrocks ~ Salt Lake City, UT

The name *Athyrium* has had several explanations for its origin but none of them official. One suggests reference to the indusia, another suggests from the Greek “athoros” which means “good at breeding”. This might be so considering the many cultivars of this genus. Athyriums are also notorious for sowing themselves almost anywhere, including carefully planted spore cultures. The species name “niponicum” simply means “from Japan”, although the type of this species is also native to Korea, Manchuria, China, and Taiwan. It is most often encountered in the wild in shady places in lowlands, being a rather common fern. The type of this species is essentially mid-green in color but the variety or varieties designated ‘Pictum’ are for the most part tri-color in a “standard spectrum of shades” as Sue Olsen puts it. “‘Pictum’ is from ‘picta’ which means painted or variegated”. The wine-red coloration, which is mainly confined to the rachis and midribs of the frond and pinnae, grades delicately into gray-green and darker green and even in some, a hint of blue. Some even have a slight metallic look to them. There are a number of varieties in cultivation with names like ‘Ursula’s Red’, ‘Silver Falls’, ‘Regal Red’ (see photo page 76.) ‘Apple Court’, and ‘Burgundy Lace’. It is said that specimens develop their best color in light shade. ‘Branford Beauty’ and ‘Ghost’ ferns are believed to be possible hybrids with *A. filix-femina*, the lady fern, being of a larger size. *A. niponicum ‘Pictum’* has, in the past, been labeled as *A. goeringianum ‘Pictum’* or *A. iseanum ‘Pictum’* but these names actually apply to other Asian species. Some varieties of this species could be confused with other Asian species such as *A. otophorum* which has a dark burgundy stipe and rachis, as well as *A. yokoscense*, which at a glance could be mistaken for a variety of *A. niponicum*. The Japanese painted fern is hardy to zone 4 but will tolerate subtropical climes if not too dry.

Description:

The rhizome is slender but compact and more or less short creeping. The stipes are a pronounced burgundy, roughly half the length of the frond. They bear rather sparse, pale brown, membranous scales which are broadly linear. The one to two foot deciduous fronds are ovate to narrowly so and bipinnate. There are usually 6 to 10 pairs of pinnae which alternate except the lowest two. They are broadly lanceolate to long-acuminate, somewhat oblique, that is, unequal sided or slanting. The pinnae are stalked, having a petiole. The pinnules are broadly lanceolate to ovate and acutely toothed, the lower ones showing the trace of a stalk. The upper pinnules are decurrent on the rachis. The sori are arranged in a herring-bone pattern, characteristic of the genus, and are uniformly spaced, found adjacent to the veins of the pinnules. At maturity they are brown. The elongated indusia are attached on the vein side and are lunate-lanceolate and irregularly toothed.

Culture:

This is certainly one of the most popular garden ferns. As mentioned previously, it is hardy in zone 4 through 9. It is probably best planted where it will have a cool root run. The soil should be neutral to slightly acid and kept damp. Aside from its soft pastel greens, the wine-red and greenish grays and hints of blue seem to suffuse together, making them a very pleasant sight in the garden. Medium to high light in shade seems to bring out the colors best. Direct sunlight can scorch them and fade the colors. New fronds continue to unfold into late summer and even into the fall. Propagation is either by division of the rootstock or by spore culture which can on occasion produce something slightly different than seen before. There has been reported a dwarf form and crested ('Applecourt') and ruffled varieties are known. The Japanese painted fern is quite striking in a mass planting but be careful not to paint yourself into a garden corner.

References:

- Ohwi, Jisaburo, 1965, *Flora of Japan*, Smithsonian Institution, Washington D.C.
- Olsen, Sue, 2007, *Encyclopedia of Garden Ferns*, Timber Press, Inc., Portland
- Hoshizaki, Barbara Joe, and Moran, Robbin C., 2001, *Fern Grower's Manual (Revised)* Timber Press, Inc., Portland
- Mickel, John, 1994, *Ferns for American Gardens*, Macmillan Publishing Co., New York
- Jones, David L., 1987, *Encyclopaedia of Ferns*, Timber Press, Inc., Portland
- Foster, F. Gordon, 1984, *Ferns to Know and Grow*, Timber Press, Inc., Portland
- Rickard, Martin, 2000, *The Plantfinder's Guide to Garden Ferns*, Timber Press, Inc., Portland

Welcome New Members!

Ron Bruno

Kathleen Livingston

Missouri Botanical Garden Library

Robert Pfau

Giles Reed

Marjorie J. Livingston

Mark Lyke

Beverly Morrow

Erik Pihl

Belated Mother's Day 2013

Jo Laskowski ~ Seattle, WA

Mom—whether she meant to or not—managed to insinuate a sense of mystery into this daughter’s otherwise stubborn, analytical, and thoroughly cynical head. She was good at stuff like that.

On a soggy Saturday in mid-May 2013, Hardy Fern Foundation guests were booked for a “Trillium Tea, Talk & Tour of the Trillium Trail” with Susie Egan at her Cottage Lake Gardens. It was a well-attended event, graciously held in Susie’s and Kevin’s home. Like a lot of small nurseries, the boundaries between “house,” “garden,” and, in this case “lecture room,” are fluid, so we had only to finish up our light lunch before just stepping out the front door for the Trillium Tour on the, well, Trillium Trail.

There are currently 48 described species of trillium. Guess who has all of them? And will—I’m certain—acquire the two newly described species, for a total of 50. And who belongs to an international seed exchange so that this plant—which is endangered in many of its growing areas—might be preserved? The serenity of the Trillium Trail in the Doug fir understory belies the time taken and the hair-pulling while Susie brings her seeds to flower, but she’s singularly successful at it.



Trillium Trail ~ Cottage Lake Gardens

Photo courtesy of Susie Egan

It was an innocuous statement. “Trilliums are always blooming on Easter.” That’s what Mom said. I thought she was nuts. How could she possibly know that? How could a plant coordinate itself with a floating holiday? And one that relies on a lunar event for its determination, no less?

Over the years I'd occasionally find myself at the intersection of Easter and a garden. If they were there, I inevitably found a blooming trillium. Despite the show of friendly joshing between mom and me, it was becoming irksome, this repeated confirmation of her statement. And what I'd never say was that it was spooking me.

It was a September when I bought my house. In March I was shocked to discover that trilliums came with it—I was haunted. Mom died. I was haunted. Over time, I fell more headlong and more headlong into trees and ferns and gardening. The presence and timing of the trilliums is more and more and more magical.

Thank you, Mom.

Love,
Jo.



What Is It With Those *Osmunda* Spores Anyway???

Sue Olsen ~ Bellevue, WA

It's that time of the year again. The osmundas are filling the air with clouds of bright green spores eager to fill the propagators' maternity wards with lovely little prothalli. And for many of us both here and abroad that's the end of the story! If they could smile, I'm sure they would smile (laugh) at us, but they don't, preferring to just sit around. We lovingly tend them offering regular encouragement and refreshment in the form of a water spritz plus the comforts of warmth and light. Still they sit or if you wait long enough develop molds or invite algae in for company. But fronds??? Don't be silly. Oh, I'll confess that on occasion after an eternity of waiting I've had some actually develop sporophytes and grow into, yes, plants. However, that is not the usual result. And so as I check my new cultures daily, I remind myself that somehow, somewhere sometimes they do grow. And I KNOW there's a secret out there somewhere amongst fellow growers ☺. So, dear readers if you succeed in this endeavor and would be willing to share your suggested method(s) there are many of us who would be most grateful. We could even send you some of the progeny!

Please send your submissions to me at
2003 128th Ave. S.E.
Bellevue, WA 98005

Or better yet, by e-mail to foliageg@juno.com.
And we'll publish them in a future issue of the Quarterly with many thanks.

A Frond By Any Other Name...PART II

Joan Eiger Gottlieb ~ Pittsburgh, PA

FERTILE AT LAST

Aside from photosynthesis, the most important function of a fern frond is the production of asexual reproductive cells called spores. The back (abaxial) side of ordinary, green fronds is the “typical” location for them, usually in association with veins, and always encased in protective sacs called sporangia. Life on land is precarious, so the safeguarding of vulnerable reproductive cells is an existential necessity for terrestrial organisms. Sporangial initials arise on leaf primordia while they are still developing in the crosier, so fertility is established (or not) on a frond during its early formation. Bulges (receptacles) develop over veins, and groups of sporangia (sori; sing. = sorus) pop up, ultimately visible to the naked eye as brown “dots” on the mature frond. Each sporangium (visible with a good hand lens) within a sorus consists of a protective, sterile jacket – one cell thick with strengthened, outer cell walls (the annulus) and a weak-walled area (stomium) that snaps open at maturity as it dries, catapulting ripe spores outward as the annulus snaps back. Many ferns provide an additional protective layer for their sporangia - the indusium - a sheet of cells that grows up from the epidermis of the frond and forms a flap over the young, developing sori. The shape of the indusium is helpful in identifying genera – peltate in *Polystichum*, reniform in *Dryopteris*, linear in *Asplenium*, cup-like in *Dennstaedtia*, etc. Even when no formal indusium is present (or in addition to an indusium) the edge of the frond may fold backward to proffer an enclosing embrace (*Adiantum*, *Pteridium*). From studies of young *Osmunda* primordia explanted to a tissue culture, Harvey and Caponetti⁶ showed that darkness and high sucrose concentrations (8%) are important factors when inducing sporangia (conditions that actually prevail in the apical bud), but that light and low sucrose (2%) are required for spore maturation (conditions faced by fully formed fronds).



The spores that are eventually shed come from meiotic division of 16 or more, typically (but not necessarily) diploid, spore mother cells (sporocytes) inside each sporangium. Meiosis (remember Botany 101?) involves two consecutive nuclear divisions at the end of which each mother cell will have produced four daughter cells. In animals these are the gametes (eggs and sperms), each with half the parental chromosome number and a new mix of parental chromosomes (and genes). In plants these are the spores. Simple as shuffling a deck of cards and cutting it in half! The 64 or more dust-like spores that each sporangium spawns are wind or water dispersed, often over impressively long distances. The fragile spores are commonly protected by species-distinctive, ornate cell walls, although a few ferns (*Osmunda*, *Lygodium*, etc.) have thin-walled, short-lived, green spores. Under favorable conditions, spores complete

Asplenium bulbiferum, pinna section showing linear sori (pale indusia with brown sporangia in view at open edge of indusial flap) plus a maturing bulbil plantlet - two types of asexual reproduction on one frond.

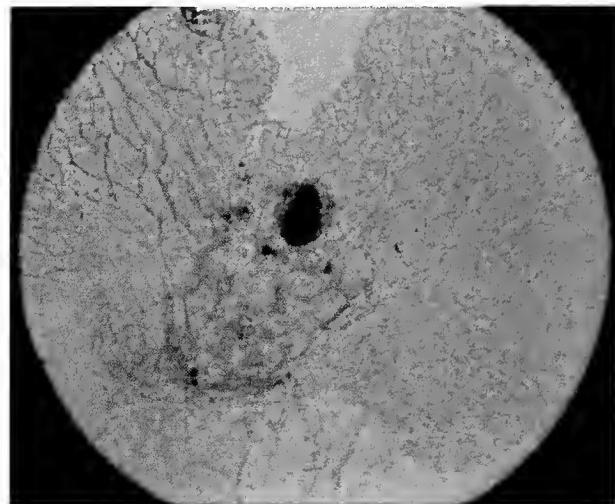
Photo courtesy of Joan Gottlieb

the life history of the fern by germinating on moist ground and growing into tiny, free-living, tissue-paper-thin, sexual plants (gametophytes). By ordinary mitosis of cells on the lower surface of the gametophyte, archegonia (elongated jackets enclosing one egg cell each) and antheridia (spherical jackets surrounding a group of flagellated sperms) are produced in a timing pattern that reduces the chance of self-fertilization. Once again the concept of protective jackets around vulnerable reproductive cells on land is realized. (Recall the sporangial jackets around developing spores.) Antheridiogens⁵ (hormones that induce sex organ formation) are active in young fern gametophytes. Sperms are released on films of rainwater and swim down archegonial necks, fertilizing eggs, and restoring the species chromosome number. Assuming cross-fertilization, the magic of independent chromosome sorting during meiosis (when spores were formed) will often give each embryo and sporeling a unique bit of genetic variability, although this is hardly universal in ferns. There is a lot of self-fertilization in small or isolated fern populations, and desert ferns are mostly apogamous, propagating clonal sporophytes from gametophyte cells without any fertilization. Anything goes when it comes down to survival under unfavorable conditions or in inhospitable places.

As if all this were not confusing enough, aquatic ferns (e.g., *Marsilea*, *Salvinia*) as well as spike “mosses,” (*Selaginella*), and quillworts (*Isoetes*) are heterosporous (producing two types of spores), independently evolved in each group, while extant terrestrial ferns are homosporous (all spores the same). In heterosporous plants small spores (microspores) and large spores (megasporres) grow into male and female gametophytes respectively—the seed plant pattern, again of apparently independent origin. For still more confusion, hybrid ferns are often sterile (their chromosomes lacking the pair matching compatibility needed for meiosis and the creation of viable spores). Hybrids often can be recognized by their shrunken, abortive spores. Some hybrids undergo spontaneous chromosome doubling (allopolyploidy), restoring meiotic pairing and producing viable spores. Such hybrids can have tetraploid or even larger genomes (e.g., the allotetraploid *Asplenium pinnatifidum*). There is quite a bit of allopolyploidy in ordinary fern species. The hart’s tongue fern *Asplenium (Phyllitis) scolopendrium* is found both as a rare, tetraploid American sub-species and a common, diploid, European one, the latter popular in British gardens for its many horticultural cultivars (“scolies”).

LOCATION, LOCATION, LOCATION

There is lots of variation in sporangial placement. In the Osmundaceae sporangia replace the lamina on pinnae at the tip of mature leaves (*Osmunda regalis*), on pinnae in the middle of fronds (*Osmunda claytoniana*), or on all pinnae of special, separate, fertile fronds (*Osmundastrum cinnamomeum*), (see photo page 76), the latter being a great example of dimorphism (leaves of two types) – in this case fertile vs. photosynthetic. The fertile fronds emerge first, turning cinnamon-colored as their short-lived, green



Gametophyte with embryo. The dark sporophyte mass is bulging from the lower side of its parent gametophyte.

Photo courtesy of Joan Gottlieb

spores are shed and the sporophylls wither away. They are followed by waves of green, sterile fronds that last all season. *Matteuccia struthiopteris* (ostrich fern) and *Onoclea sensibilis* (sensitive fern) reverse the sequence, sending up their familiar green fronds in the spring, followed by very distinctive, fertile ones (lacking lamina tissue) in late summer. The latter turn brown and woody, lasting through winter before shedding ripe spores. In the genus *Botrychium* the fertile pinnae are at the base of the single, seasonal, green frond. They behave like forks or branches growing upward, resembling bunches of mini-grapes on stalks, even overtopping what is developmentally the true tip of the frond. In all these cases, the sporangia literally take over the lamina of the pinnae on which they form, leaving only a rachis, stipe, and veins.

Placement of sori on pinnae or lobes only at the tips of ordinary, green fronds is rather popular among ferns, occurring not only in *Osmunda regalis* as already noted, but in *Polystichum acrostichoides*, *Dryopteris celsa*, *Lygodium palmatum*, and *Platycerium bifurcatum*, to name a few. There are even different gradations of reproductive dimorphism. In *Woodwardia areolata*, *Thelypteris palustris*, and other dimorphic species, the fertile fronds are simply skinnier, and sporangia reduce or replace only part of the lamina. In *Asplenium platyneuron* the dimorphism is subtle. Sterile fronds form early and are small and prostrate. As the season progresses, much taller leaves uncoil to upright attention and bear sporangia in the typical fern way, on their abaxial (back) sides. Adding a touch of surprise, fertile pinnae sometimes emerge on fern fronds, form a few sporangia-bearing segments, and then, in a “change of mind” (more likely a lack of enough stored energy or water, or even a somatic mutation) complete their growth with sterile tissue only. And not all dimorphism is related to reproduction. Epiphytic staghorn ferns (*Platycerium*) produce green, deeply lobed, pendulous fronds with sporangia literally covering their finger-like tips (an achrostichoid pattern with no aggregation into sori). Occasionally, the staghorn generates a very different, rounded, ballast frond that is initially green, fades to brown, and tightly clasps a tree trunk or other support. Fern fronds reflect considerable variation on the foliar theme, undoubtedly a good thing in a fickle environment.

Extrapolating this developmental leaf plasticity to flowering plants, we see one type of modified reproductive leaf (the stamen) reduced to a vascular stipe (the filament) bearing a few microsporangia (anthers) producing microspores (pollen) through meiosis. Another type of reproductive leaf (the pistil) is a rolled, and sealed container enclosing one or more megasporangia at its base (“ovary”). The tip of the pistil is variously shaped and embellished to form a landing platform (stigma) for microspore pollination. Between stigma and “ovary” the pistil has a nourishing neck (style) through which the tube-like male gametophytes that sprout from the microspores (sporting two sperm nuclei each), can grow toward the “ovary.” There, inside the megasporangia, minimalized, trapped, female gametophytes are developing, just a vestigial, 8-nuclei each, one of which is a functional egg. Following a unique double fertilization (of a second female gametophyte nucleus by the second sperm within the pollen tube), each megasporangium, enclosed embryo, and nutritive endosperm tissue from the second fertilization forms a seed (a “mature megasporangium”). The pistil wall (original, rolled leaf plus, in some cases, accessory floral tissue) may swell, harden, or otherwise transform itself (ripen) into

a dispersing fruit - a “ripe megasporophyll.” No free-living gametophytes, swimming sperms, or external water are needed. It was the great angiosperm land conquest.

That the reproductive structures of all vascular plant sporophytes are leaves or parts of leaves gives new meaning to “remodeling.” The megaphyll itself is a re-formed branch. The spore-bearing fronds of ferns, the pistils, stamens, petals, and sepals of angiosperms, and the seed-bearing parts of gymnosperm “cones” are all modified megaphylls, custom designed through evolutionary selection to maximize their job performance. Think of that the next time you enjoy an avocado (a ripe pistil that is green, reminding us that it is merely swollen, rolled, leaf tissue entrapping a ripe megasporangium (seed). Relate it to the sporangium-bearing fronds (sporophylls) of your favorite fern. Remember, too, that the feathery, 15-foot long *Cyathea* frond or the 0.2-inch, scale-like *Azolla* leaf starts as a primordial cell at the shoot apical meristem, as do the leaves of all seed plants. Anyone can appreciate the in-your-face colors and textures of the flowering plants. To the discerning eye there is just as much architectural interest, diversity, and developmental nuance, albeit less eye catching, in the fascinating fronds of ferns. Enjoy and befriend them at will.

REFERENCES CITED - From Part I and Part II

- 1) Wardlaw, C.W. (1956). A note on the effect of isolating the fern shoot apex by shallow incisions. *Phytomorphology* **6**, 55-63.
 - 2) Steeves, T.A. and Briggs, W.R. (1960). ...*Osmunda cinnamomea* L. The auxin relationships of expanding fronds. *Journal of Experimental Botany* **2**, 45-67.
 - 3) Gottlieb, J.E. (1965). Experimental control of the shoot system in sporelings of *Pteridium aquilinum*. *American Journal of Botany* **52**, 359-368.
 - 4) Ibid. (1972). Control of marginal leaf meristem growth in the aquatic fern *Ceratopteris*. *Botanical Gazette* **133**, 299-304.
 - 5) Ranker, T.A. and Haufler, C.H. (Eds.) (2008). *Biology and Evolution of Ferns and Lycophtyes*, Cambridge, Cambridge University Press.
 - 6) Harvey, W.H. and Caponetti, J.D. (1973). *In vitro* studies on the induction of sporogenous tissue on leaves of cinnamon fern. *Canadian Journal of Botany* **51**, 341-349.
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“Pteridotrvia”

*What fern is credited with helping to cool down the earth back
in the days when palm trees grew in the Arctic???*

Visit our homepage, www.hardyferns.org to find out.

The Benmore Fernery

Mary Gibby

Historic Gardens, 2010

Author Mary Gibby is the director of science at the Royal Botanic Garden Edinburgh and the past president of the British Pteridological Society. Her research studies on ferns and their conservation have taken her from the Atlantic woodlands of Argyll to the Macaronesian Islands and Bhutan. She is the author of *The Benmore Fernery: Celebrating the World of Ferns*, RBGE, Edinburgh, 2009.

The Benmore fernery is a unique building in a remarkable setting. It occupies a remote site in Benmore Botanic Garden, Argyll. Nestled against the steep contour of a south west facing hillside, the fernery incorporates a cliff on its eastern side as an integral part of the structure. It was constructed in the early 1870s at the height of the Victorian fern craze, but went into decline in the early 20th century and lay derelict for nearly 100 years.

Ferneries are part of a strong tradition in Britain, one that reached its height in the second half of the 19th century when the country was gripped by ‘pteridomania’: the fern craze. It was Charles Kingsley, clergyman, naturalist and later author of *The Water Babies*, who coined the term pteridomania in 1855 to describe the fascination for ferns that was gripping the nation. It was manifested not only in the cultivation of ferns but in ‘fern ramblings’ and in a host of activities involving the identification, collection and exchange of fern species. The craze encompassed both British and exotic varieties, and it involved an impressive array of associated structures and paraphernalia.

Pteridomania was sustained by the publication of a wide range of literature, from short guide books to lavishly illustrated volumes of paintings and exquisite nature prints. Evidence of the passion for ferns remains with us in the form of the decorative fernware that made its first significant appearance at the 1862 International Exhibition in London in the form of fern-decorated pottery by Wedgwood and Dudson, etched fern glassware and fern-decorated wooden ‘Mauchline ware’. The Coalbrookdale Company of Shropshire produced decorative cast ironware in fern-like designs, including a range of cast iron garden seats. Unfurling fern fronds embellished grave stones and ornamental garden stonework. The decorated urns at Dawyck Botanic Garden, for example, are encircled by fronds of the hart’s-tongue fern and date from the 1840s.



Photo courtesy of
Mary Gibby;RBGE



Osmundastrum cinnamomeum
in early spring.

Photo left courtesy of
Joan Gottlieb



Athyrium niponicum
‘Regal Red’

Photo above courtesy of
Sue Olsen



At Benmore, tree ferns
soar in the upper level,
set off the glass roof
dramatically, and define
the entire space.

Photo left courtesy of
Jeanie Taylor



Cottage Lake Gardens

Photo right courtesy
of Susie Egan

Philadelphia Flower Show ~ 2013

The Fox and the Fern

Photo left courtesy of
Jack Schieber



**The lower level is dim; an interesting stair leads the imagination upward....
Benmore Fernery**

Photo right courtesy of
Jeanie Taylor



**Approach to the Benmore fernery.
(Which does not in fact tilt!)**

Photo above courtesy of
Jeanie Taylor



Knees of *Todea barbara* obscured by the always-lush *Woodwardia unigemmata*.

Benmore Fernery

Photo below courtesy of Jeanie Taylor



There was a tremendous enthusiasm for cultivating ferns in ornamental Wardian cases (miniature glasshouses), fern gardens and, of course, ferneries like Joseph Paxton's magnificent Tatton Park fernery in Cheshire and Kibble Palace, now gracing Glasgow Botanic Garden but first erected at Coulport, Loch Long.

Unfortunately, the passion for fern growing was accompanied by an obsession with collecting them from the wild, especially rare species. The populations of oblong woodsia (*Woodsia ilvensis*) that grew in the hills near Moffat in Dumfries and Galloway were devastated by collectors following the completion of the Carlisle-to-Edinburgh railway line over nearby Beattock summit in 1848. As the craze continued even the more common species suffered. John Hutton Balfour, Regius Keeper at the Royal Botanic Garden Edinburgh (RBGE), reported in 1870 that:

The ferns in Arran are gathered in vast numbers, and nearly all the accessible specimens of the rarer species are taken away... we saw boys and women carrying large quantities of ferns taken up by the roots with a view of making a profit by the sale of them.

THE ORIGINAL DESIGN

The Benmore fernery was constructed for James Duncan, a wealthy sugar refiner. He had purchased the Benmore Estate on the Cowal Peninsula in 1870. During the 1870s he made many changes, with additions to the main house, the walled garden and the stable block. He also planted over six million trees, mainly conifers, across the estate. Adjacent to the house he built a large picture gallery for his extensive art collection which included contemporary works by the French impressionists, and an experimental sugar refinery.

Duncan's heated fernery was at some distance from the other buildings in an area that had been recently planted with conifers. His picture gallery, sugar refinery and fernery have been described recently by architect Michael Thornley as 'uncompromising buildings...allied more closely to industrial rather than domestic styles of architecture of the time' and as 'strictly functional'. Nevertheless, the setting of the fernery on the hillside, with its thick walls, towering south gable and curved glazed roof is extremely dramatic. The building takes the form of a stone casket embedded into the steep hillside with a glazed barrel roof.



Embedded in a steep hillside, the derelict fernery presented a challenging site for all concerned. *Photo courtesy of MAST Architects*

One can imagine Duncan's visitors first marvelling at the stunning collection of paintings in his gallery and then being conveyed across his estate to his other secret treasure house, the fernery. Here they would have climbed the steps to a small doorway at the foot of the massive gable

end and entered under a dark vaulted entrance porch. Stairs on either side led up to the broad middle level where the visitor finally emerged into a steamy, green paradise beside an ornamental grotto that arched over an oval pool. Here they would have been greeted by a profusion of ferns in every direction: beside the paths, rising up beside the steps, suspended from the walls and probably with the broad fronds of tree ferns silhouetted against the glazed roof. Steps and paths edged in white quartz formed a winding, figure-of-eight route for exploring the interior. To the left and right of the grotto two further sets of narrow stairs reached up to the highest level, under the short north gable and beside another fern bed constructed above the grotto. From every wall of the fernery cantilevered stones protruded, providing further platforms for plantings, while the damp exposed cliff face inside the fernery provided a further natural habitat.

With its south west aspect, the highest level in the fernery would have benefitted from sun for much of the day, while plants closer to the entrance, below the great south gable, would have been in deep shade. Hidden beside the paths were vents from the heating system, connected to an extensive network of underground pipes that conducted warm air from the boiler below. Upkeep of the fernery would have been a costly undertaking: glasshouses were expensive to maintain and the coal-fired boiler would have needed daily attention.

James Shirley Hibberd, a 19th-century horticulturist and editor of *The Gardener's Magazine*, provided long lists of ferns recommended for cultivation under different conditions in his book *The Fern Garden* (1869). Hibberd advised on how to construct and lay out a fernery to achieve a natural effect, recommending building on a slope to gain from the range in temperature that could be realised in a heated fernery.

The location and construction of the Benmore fernery reflected these recommendations. It has a large rectangular footprint and was originally covered by a glazed arched roof. The three thick walls – the long west wall and the two rounded gables – are constructed of schist rubble and lime mortar, while the fourth wall is formed largely by the cliff itself. The fernery's position at the side of a steep gully means that its floor is on three levels; the uppermost (north) gable is fairly low, equivalent to one storey, whereas the lower (south) gable towers up out of the hillside, reflecting the considerable change in height within the building. On the west side, at the lower end of the long wall is a small lean-to building where the coal-fired boiler was housed.

Remnants of the original roof of the fernery showed that it was carried on semicircular iron trusses, supported on buttresses capped with substantial padstones to spread the load. The glazing had been supported in wooden overlapping frames, presumably held in place with putty. However, the detailed structure of the frames had been lost, and there was no trace of the 'lantern' that ran along the ridge of the roof, other than the small gablets where it met the top of each rounded gable.

BENMORE IN DECLINE

Following the introduction of a German sugar bounty, Duncan became bankrupt and had to sell the estate in 1889. It was purchased by Henry John Younger as a sporting estate and

he introduced an impressive collection of rhododendrons. The fernery, being expensive to maintain, probably started to fall into decline following the change of ownership, but, while the picture gallery and sugar refinery were demolished, the fabric of the fernery remained, its isolated position perhaps helping to ensure its survival.

Through the generosity of Henry Younger's son, Harry George Younger, the Benmore Estate was gifted to the RBGE in 1930. The fernery was already derelict by then and, although it was structurally maintained for as long as possible, some 15 years ago the building had to be closed to public access.

Unfortunately, no written or visual records of the fernery at Benmore in its heyday have been found, nor any reports of the species under cultivation, nor any photographic archive, and so we can only speculate on the diversity of species that were cultivated. Following exposure to the elements for probably a century it is not surprising that the original collection of ferns has long since disappeared. Prior to restoration, with the roof open to the sky, the derelict fernery remained a fernery of sorts nonetheless, having been invaded by a jumble of native species that luxuriated in the cool, moist and shady conditions. And in the year before restoration an exotic brittle bladder fern, *Cystopteris diaphana*, a species more commonly found in Madeira and the Azores, was discovered lurking in the grotto beside the pool; perhaps it was one of the original denizens.

CONSERVATION

In 1992 Historic Scotland designated the fernery a category B listed building, describing it as 'a rare structure and important as an integral part of the gardens at Benmore'. Listing the building proved to be a great stimulus for generating interest in the surviving features, and its restoration was championed by the Friends of Benmore and, in particular, by the Younger (Benmore) Trust. Established by HG Younger in 1930, the trust covered the running costs of the garden and is now used to support projects within the garden. The trust was keen to see the fernery kept and accordingly commissioned a feasibility study by MAST Architects of Glasgow.

The detailed research required for the feasibility study revealed how the building had been constructed. The thick walls, tall gables, and lean-to boiler house appeared relatively unscathed. Much of the internal design was still evident even after 100 years of decay, although the vault over the entrance had been demolished and details of its construction were sparse. There were remnants of the staircases on either side of the porch, the grotto



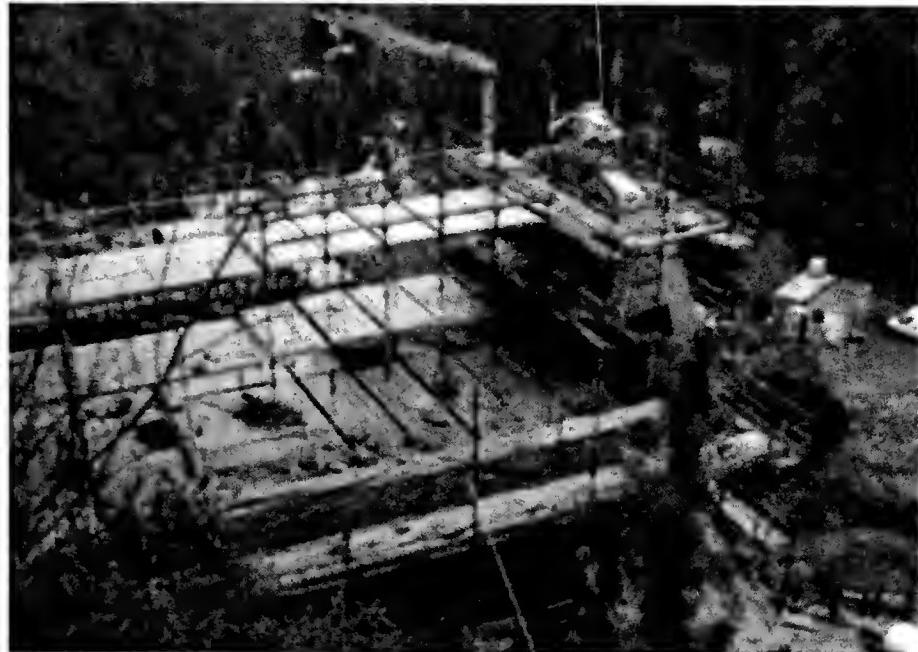
The derelict fernery with its towering south gable.

Photo courtesy of MAST Architects

and pool had survived, and there was evidence of the upper staircases that led above the grotto. A few of the iron hoops that supported the original roof were also still in place.

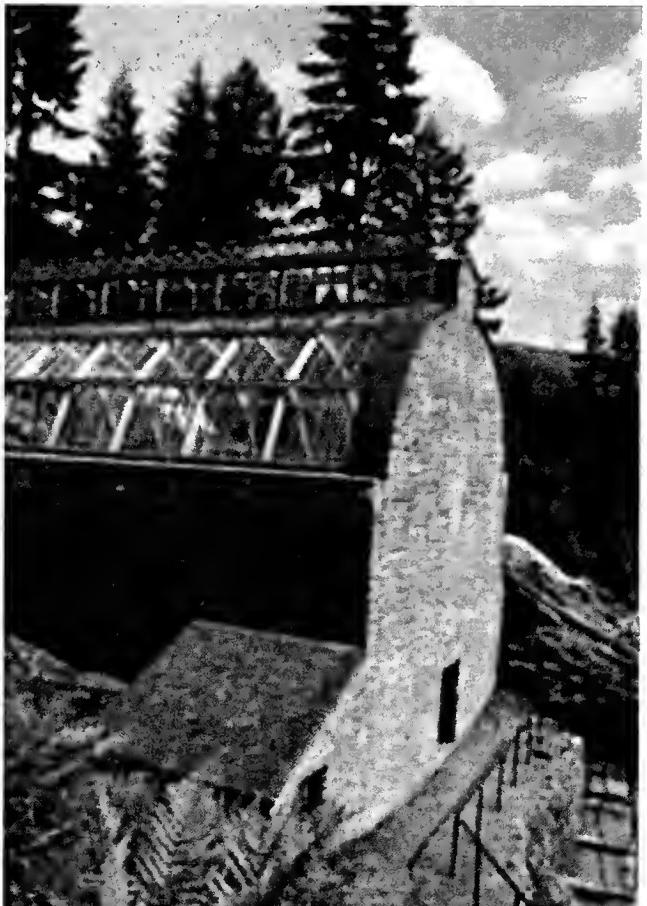
A meeting on site between the architect, Michael Thornley, and Historic Scotland was critical to establishing whether any form of restoration was feasible.

To reconstruct the glazed roof to the original design using the rather



Above: Work in progress.

Photo courtesy of MAST Architects



Above: The exterior of the finished fernery.

Photo courtesy of Lynsey Wilson; RBGE

insubstantial iron hoops and conventional wooden supports would have created enormous problems for long term maintenance. However, as there was nothing left to indicate how the ridge-lantern had been constructed, nor how the structure was ventilated, its restoration would have been largely conjectural. It was therefore decided to put forward proposals for an entirely new glazed barrel vaulted roof constructed with modern materials. Historic Scotland concurred, opening the way forward for the conservation of the surviving features under new glazing; but there was still the matter of funding the project. This was achieved with the support of significant donations by the Heritage Lottery Fund, the Younger (Benmore) Trust, the RBGE Members' Appeal and many private donations.

Restoration work started in May 2008. The site was secured and plant and facilities were brought in, including a crane to raise equipment from the work base at the bottom of the gully to the level of the fernery. The first task was to restore the walls. Scaffolding was constructed inside and out so that every area of wall could be cleared of vegetation and repointed. The upper walls and especially the upper gable ends needed particular attention. Significant elements had to be taken down and rebuilt. Regular meetings between the contractors, the architect and RBGE staff ensured that the challenges of reconstruction work were overcome. Despite heavy rain in October 2008, work progressed well during the autumn, and the final critical measurements could be made to allow accurate construction of the metal arches to support the new roof glazing. By early December the

arches had arrived from Belgium and were being positioned so that by Christmas most of the glazing was in place.

With the glazed roof and lantern in place, the internal scaffolding could be removed to allow work to start inside the fernery rebuilding the vault over the entrance, repairing the grotto, reinstating the paths and steps, and reconstructing the water supply. There is no electricity in the building; the ventilation in the lantern is operated manually, and the water supply relies on a gravity feed. The barrel vaulted glass roof has a curved ladder on each side to provide access for maintenance, and these ladders can be cranked manually to move them between the gables.

The completed structure, with the newly restored walls, wall heads protected by thick lead flashings and newly constructed glazed roof, is stronger today than when it was first erected in 1870, a fact that bodes well for its future.

THE FERNERY TODAY

The fernery was re-opened to the public in September 2009. In the absence of any historical records, RBGE horticulturist Andrew Ensoll has used his knowledge and long experience of fern cultivation to design the plantings, selecting ferns from many parts of the world for their diversity of form, as well as the diversity of their origins.

Most of the ferns have been grown from spores at RBGE, and over 75 per cent are of known wild origin. All are from temperate or warm temperate regions, with many from the southern hemisphere. They include species native to the Juan Fernandez Islands in the Pacific Ocean off the coast of Chile and others from the Azores, Hawaii, South Africa, New Zealand and Tasmania. Some are now rare in the wild and in need of conservation protection.

The Victorian fern craze is now largely forgotten, a curious fragment of Britain's cultural and botanical history, but when visitors find themselves inside the restored fernery, a lush green world apart, they might feel a touch of pteridomania themselves. Furthermore, by preserving historic fabric and promoting biodiversity the project has successfully united two different but related forms of conservation. Both the restored building and the remarkable plants it shelters are the product of a belief that we have a duty to keep such unique treasures alive.

This article was first published in the 2010 edition of Historic Gardens and it is reprinted here with the kind permission of the UK publisher, Cathedral Communications Limited (www.buildingconservation.com).



Tree ferns flourishing in the renewed fernery.

Photo courtesy of MAST Architects

The Royal Botanic Garden Edinburgh

Jeanie Taylor ~ Seattle, WA

All photos courtesy of Jeanie Taylor.

“The Royal Botanic Garden Edinburgh was established in 1670 and during the 20th century acquired three Regional Gardens – the mountainous **Benmore** in Argyll; **Dawyck** in the wooded hills of the Scottish Borders and **Logan** on the Gulf Stream-warmed southern peninsula of Dumfries & Galloway.

Together they represent one of the world’s largest living collections of plants.”

My husband, Tom Lennon and I visited Benmore Botanic Garden in August 2012. I wanted to see the restored fernery in particular, but there is much more if you are able to make multiple visits – as they say on their web blurb it is one of the WORLD’S LARGEST living collections!

Our adventure started with a bus ride from our modest B&B in Glasgow’s west end – not far from another fabulous structure – the Kibble Palace – truly a palace, chock full of the **National Collection of tree ferns** (first planted in the 1880s). We did not have time to fully explore the wonderland of plants inside and outside the beautiful glass houses, but enjoyed an hour or so with the most amazing modern exhibit design – matched perfectly to the glasshouse and the collections. I enjoyed the appreciation of all things biological, including an entire exterior sign devoted to pillbug biology (or woodlice as they call them) displaying an admirable regard for the humblest creatures that support us on the planet.



Unfurling tree fern crosier

We departed for the Argyll peninsula, on a train heading west from **Glasgow Central** Train Station – remarkably romantic in its similarity to the station in the movie ‘Hugo’. The train would deposit us at the ferry dock in Gourock.

A short ferry ride brought us to Dunoon, on the Cowal peninsula. We ended up waiting for a local bus out to Benmore,

because we spent a little too long wandering around town and looking for a cheap lunch. Passing the time at the local hotel (which, like the rest of the town seemed to have seen grander days), I enjoyed looking at wall ferns (*Asplenium sp.*) on the terrace as we were sipping tea in the August drizzle. (We never left without our rain gear, and it is still raining as I write this in March). By the time we arrived at the garden, the afternoon was waning. We had to really hoof it to get to the fernery and back before closing. The

grounds cover 150 acres and are surrounded by a relatively remote national park. It was over a mile to our goal, so we hiked (or speed-walked) through a lovely woodland that resembled our Pacific Northwest. The beginning of our walk was a dramatic entrance to the woodland through an allee of 150-year-old giant sequoias (sadly, guarded by a chain link fence to direct visitors through a disinfecting shoe wash to contain *Phytophthora ramorum* – sudden oak death).

It is worth the trek. This magical fernery is perched on a rocky hillside, tucked into the landscape (the ancient rocks here are a whole other story – some surface rocks are almost as old as the earth.). (See photos page 77) There were not many visitors that day, and we had the place to ourselves for a while. We entered the lower level on a stone pathway, as if entering a cave.

Signs explained the building's history: built during the Victorian fern craze around 1870, for years a ruin, it was rebuilt from the foundation in 2009. The new house is unheated, but the indoor climate is modified by solar gain and the buffering effect of masonry, rock, and double glazing. Do not let this abbreviated description obscure the gargantuan effort and skill it took to rebuild this fernery.

Ferns that thrive in cool temperate conditions were sourced from the wild, Royal Botanic Garden Edinburgh (RBGE), and Glasgow Botanic Garden. Three levels in the house offer cool, moist forest floor conditions, warmer mid-canopy, and an open drier climate on the top level. There is a dark grotto with a pool for aquatic species on the mid-level. (Fans of The Hobbit might think of Gollum). Ferns from New Zealand were plentiful, but South Africa, South America and the Pacific Northwest were represented too.

The middle level, stuffed with ferns and full of light was, even on a gray day a luxurious place to linger amid the greenery. Large expanses of stone and masonry add a lovely solid feel around the lightness of foliage.

The cavern – yes! there are some ferns and other dark-loving species in there, clustering around a pool. A bit sparse, but a great idea for an exhibit which will no doubt improve with age.

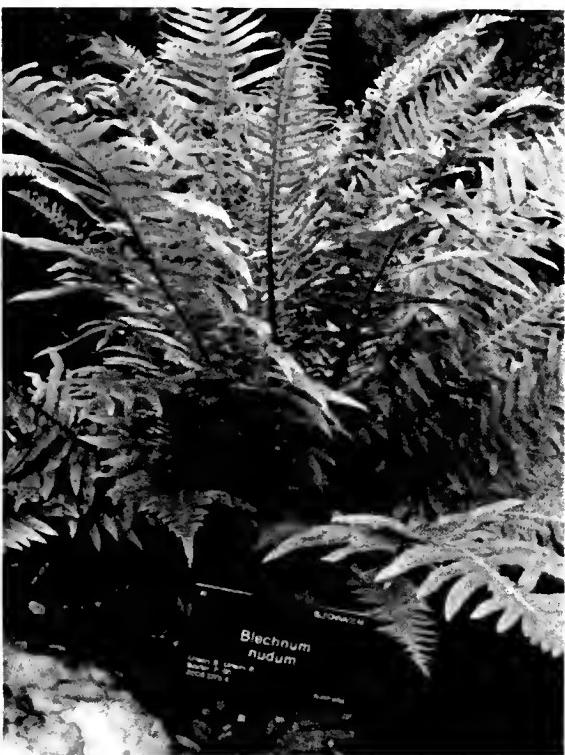
Interesting blechnums caught my eye. *B. discolor* sported fertile fronds with a scrap of sterile frond tissue along the main rib.



Allee of giant sequoias.



The cavern.



Blechnum nudum



Cycad-like *B. palmiforme* is native to open, dry “fern-bush” in South Africa and has very thick pinnae.



Blechnum tabulare



Blechnum novae-zelandiae

According to *Encyclopedia of Garden Ferns* (Olsen) furry-rhizomed *Lophosoria quadripinnata* is a single species genus cultivated by “British specialists” with “evergreen, triangular fronds to 12 ft” – impressive.

Tree ferns were the centerpieces of the upper canopy zone – even at ground level. Here hairy and impressive. (See photo page 76.)

The rock work was excellent to my amateur

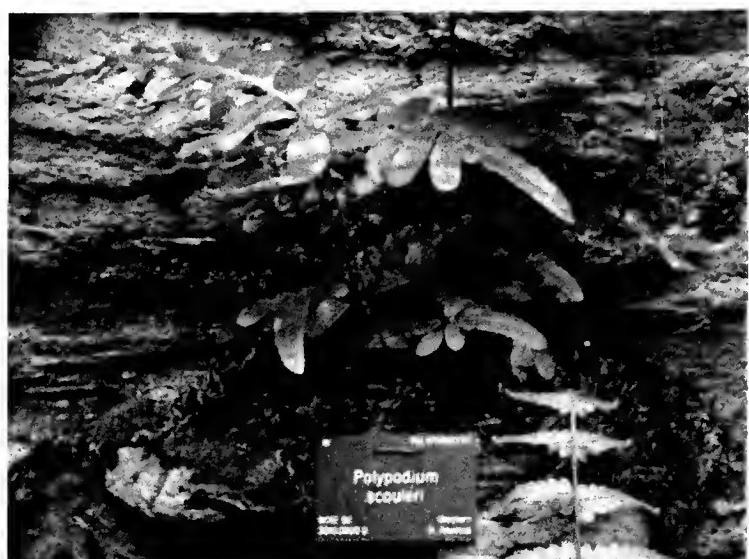


Lophosoria quadripinnata.

eye. Appropriately, many wall niches had been built to accommodate epiphytic ferns that existed in various stages of success. These must be more difficult to establish. Some specimens of *Polypodium* of the Pacific Northwest of North America, for example were not as robust as I thought they would be – perhaps not taking to the indoor climate.

Photo right: one of the more successful American Pacific NW Polypodiums – others still struggling

One of the great successes here, as in Glasgow at Kibble Palace, was *Woodwardia unigemmata*; it provided a lush backdrop in every corner of the mid and upper levels, and even on the wall. I'm sure the gardeners are grateful for its ability to fill gaps. (See photo page 77.)



Polypodium scouleri



Polystichum richardii – great color contrast

I hope these photos and brief descriptions have given you a taste of our adventure. If you have the opportunity to visit, this garden and fernery is a real gem – if you are traveling on to the Western Isles, it's on the way, but a daytrip from Glasgow is equally pleasant. Several days would be necessary to hike to all the highlights. A people-carrier type open train is available for those who are not up to the extensive walking required.



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Ferns at the Philadelphia Flower Show

Jack Schieber

Holland, PA



The Delaware Valley Fern and Wildflower Society is based in Philadelphia and has been in existence since 1975. Although we have included the term 'wildflower' in our name, we are very much an organization of fern lovers. We sponsor informative lectures at meetings, visit members' gardens and make a number of field trips each year. A final activity is to exhibit at the Philadelphia Flower Show which has been done every year since 1976. The Philadelphia Flower Show is produced by the Pennsylvania Horticultural Society and is always the first week in March. One can learn a little about it at <http://theflowershows.com/>

No activity of DVFWS engages the attention of so many members as the flower show exhibit. Long sessions are spent making plans and painting the sets at a workshop. Even more important, hardy ferns must be forced and carefully nurtured to be at their best for the show. Ferns are always necessarily a part of our exhibit since ferns are what we are about. Finally the whole exhibit must be put together on site. Each year members take turns manning the exhibit and keeping it tidy, answering questions, distributing hand-outs, and accepting compliments of the visitors.

Our first exhibit in 1976 set the tone for the years to follow. It featured a photograph of the 1776 twenty-shilling note which displayed a nature print of a pinna of *Dryopteris spinulosa* (now *carthusiana*) originally made by Benjamin Franklin in 1757. Franklin invented the nature print technique to minimize the counterfeiting of colonial currency and his successors had printed this particular note. Eight tender and four hardy ferns were in the exhibit. The judges made the comment: "Information well presented. Fern collection small but interesting."

This year our exhibit was the street side of a British pub, "The Fox and Fern" with ferns growing about, together with other pub related items we've experienced in Britain and/or learned about from our British friends. The theme of the Show this year was "BRILLIANT" and it was all about Britain.

We had about fifteen species of ferns in the Show. Although we tried to have 'British' ferns we were limited by what we had in our gardens. There is very little variety in the nursery trade and the material is usually too immature. Two British cultivars in the Show were *Dryopteris filix mas* 'Parsley' and *Athyrium filix femina* 'Victoriae'. Every different species must be labeled and must be approved by the folks who run the show. We generally know at least as much as they do but names change. For Glade Fern they had *Athyrium pycnocarpum* which was used for a hundred years. We had the more recent *Diplazium pycnocarpon*. On checking it out there are seven synonyms listed and it seems the current genus name is *Homalosorus* but if one uses *Homalosorus* the species name becomes *pycnocarpos*. Go figure.

As mentioned above providing good plant material for the Show is difficult. Members of DVFWF in the fall dig ferns from their gardens and pot them. In late December we take them to the greenhouses of the Horticultural Center in Philadelphia where the staff kindly assists us in their care and forced growth. A bit of luck is involved because the temperature and light are not controlled specifically for our ferns and some plants do well and others do not. You would think that over the years we would have learned how to do it. What we have learned is that if we are going to use fifteen plants, dig thirty for forcing.

One troubling aspect of the process is the hardship on the ferns. We dig them out when they often haven't gone dormant and then start to push them to growth when they really haven't had time for their winter rest. Then, after the show we store them in pots in some dark corner or in the garage until frost is past and they can be replanted in the garden. It takes at least a couple years for them to recover. I realize that ferns are only inanimate plants that probably don't have feelings and maybe I'm a little odd but I feel for them.



Philadelphia Flower Show 2007
Shades of Green, from the show
Legends of Ireland.

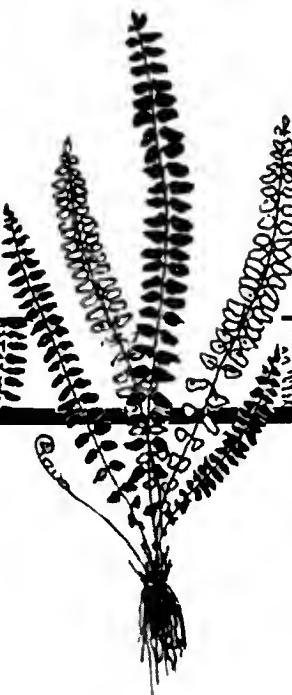
Photo courtesy of Jack Schieber

Philadelphia Flower Show 2009
Pressed for Time, from the
show Bella Italia

Photo courtesy of Jack Schieber



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